The Impact of Temporary Employment on Labour Productivity: Evidence from an Industry-Level Panel of EU Countries

Lisi, Domenico

University of Catania, Faculty of Economics DEMQ, University College London (UCL)

15 September 2009

The impact of Temporary Employment on Labour Productivity: Evidence from an Industry-Level Panel of EU Countries

Domenico Lisi*

University of Catania, DEMQ

September 2009

Abstract

In recent years the availability of new industry-level data allowed to evaluate the impact of labour market policies more consistently than previous standard cross-country studies. In this paper an industry-level panel is exploited to evaluate the impact of less stringent Employment Protection Legislation (EPL) for temporary employment (TE) in EU countries. A reduced form model is estimated to identify the overall effect on labour productivity growth. The advantage of using industry-level data is fourfold. First, as in standard cross-country studies, the cross-country variation of EPL is still exploited. Second, in contrast with the cross-country analysis, the specification allows us to control for unobserved fixed effects, potentially correlated with the level of EPL. Third, as the previous literature emphasised, the within-industry "composition effect" appears to be negligible, allowing us to identify the "independent effect" of TE. Fourth, to the extent that events in a single industry are not able alone to affect the policy in a country, the specification is less subject to the simultaneity problem between variable of interest and policy. The theoretical literature on TE has not established a clear prediction on the sign of the effect, existing different convincing reasons for both directions. Thus, the results of the analysis have potentially important policy implications. Our finding is that the introduction of temporary contracts has a negative, even if small in magnitude, effect on labour productivity growth.

JEL Classification: J08, J24, O47.

Keywords: labour productivity, temporary employment, EPL, difference-in-differences.

* The author would like to thank Roberto Cellini and Stephen Machin for the helpful comments. However, the analysis and any errors remain responsibility of the author alone.

The impact of Temporary Employment on Labour Productivity: Evidence from an Industry-Level Panel of EU Countries

Domenico Lisi

University of Catania

1. Introduction

Despite the international differences in the relative importance of temporary employment (TE), it is evident that in the last decades temporary jobs have been becoming an important feature of the labour market landscape in the majority of OECD countries. In particular, the share of TE in most EU countries has grown dramatically, raising the question of the possible effects of this structural change in the labour market.

In the different experiences of EU countries a considerable number of country-specific factors have been playing an important role in determining this change. Nonetheless, as emphasized by a growing literature, some common determinant appear to have been crucial in shaping this feature. In particular, the high protection for permanent employment (PE) along with a less stringent regulation for TE would seem to be the main explanation of the rapid growth of TE in EU countries. Similarly, the low protection of PE in the United States, the United Kingdom and other countries would explain the low use of TE made by employers.

The new scenario has raised worries that TE might increase the dualism in the labour market between high protected workers finding a stable job, after a transition from TE, and those low protected remaining in the trap of precariousness, with little prospect of upward mobility. Moreover, TE frequently offers less access to the welfare system and other fringe benefits, as unemployment insurance, sick leave, paid vacations. This dualism would represent an undesirable difference in the welfare conditions of the two types of workers in the society.

From an efficiency point of view, the increasing share of TE raises the question of what would be the impact on labour productivity. This issue would have potentially very important policy implications, especially since during the last twenty years labour productivity growth accounted for more than half of GDP growth in OECD countries (OECD, 2003).

The theoretical literature available so far has not established a clear prediction on the sign of the effect, existing different convincing reasons for both directions. On one hand, TE is disproportionally filled by younger and less educated workers, and temporary workers often have less access to training programmes. Moreover, given the temporary, and frequently short, duration of contracts it would be rationale for a firm to fix a lower reservation productivity under which to layoff temporary workers than permanent ones, in order to avoid the direct and indirect firing costs. On the other hand, TE allows firms a much more flexible and, in turn, efficient organization of resources and eliminates the disincentive to invest in risky, but potentially valuable, projects. Moreover, it might be rationale for temporary workers to exert a greater effort in order to get the renewal of the contract and/or the passage to a stable job. Therefore, the issue of the direction of the effect remains an empirical question.

While the empirical literature on the theme has already offered a convincing answer to the issue of the role of Employment Protection Legislation (EPL) on employment level, the empirical evidence available so far has not fully clarified what is the impact of EPL on labour productivity. Indeed, the issue has been already the object of interest of few studies, some of which succeed in identifying the negative impact of EPL for regular contracts. However, the strategy to identify the impact of TE does not seem to be as satisfactory as that for regular contracts. Nonetheless, to these studies has to be acknowledged the merit to have introduced an identification strategy more satisfactory than the standard cross-country analysis.

Following this new empirical literature, the aim of this paper is to shed light on this issue by assessing the impact of both EPL for regular contracts and TE on labour productivity growth. To the extent that the level of EPL and TE affects firms decision on investment and, in turn, the level of capital affects labour productivity growth, we estimate a reduced form model to capture the overall effect, assuming a Cobb-Douglas production function with constant returns to scale. The empirical strategy follows the method introduced in the finance literature by Rajan and Zingales (1998) and later extended in the other areas in economics. In the field, the papers by Micco and Pages (2006) and Bassanini and Venn (2007) introduced this approach to evaluate the impact of different labour market policies. The method exploits both cross-country variation in EPL and TE and variation in the relevance of EPL in different industries. The industry-level panel allows us to control for different specific unobserved effects, allowed to be correlated with covariates. Among others, this represents one of the most important advantages of the specification with respect to the standard cross-country analysis.

The main result is that TE has a negative impact on labour productivity growth, even if small in magnitude. In particular, an increase of 10% of the share of TE would lead to a decrease of 1% in labour productivity growth. Furthermore, the analysis confirms the findings of the previous literature that EPL for regular contracts reduce labour productivity growth more in those industries requiring for their own characteristics a greater reallocation.

The paper proceeds as follows: Section 2 introduces the main stylized facts about EPL and TE in EU countries. Section 3 reviews briefly the previous literature and discusses some theoretical issue. Section 4 illustrates the identification strategy and introduces the main features of the dataset. Section 5 presents the results of the analysis and examines the robustness of the findings. Section 6 discusses the policy implications and some final remark.

2. Labour Market and Reforms: The Stylized Facts

In the 1990s the persistency of high level of unemployment in Europe with respect to other OECD countries represented a reason of concern for many governments. Consequently, most of EU countries felt the need to intervene and reform the labour market legislation, identified as one of the main causes of high unemployment.

Despite the different forms of intervention, fairly all reforms followed a typical common scheme: new legislations did not included workers hired pre-reforms, instead affecting deeply the rules for those post-reforms; protection legislations for PE were left untouched; the use of TE was gradually liberalized.

The emergence of these asymmetric institutional changes can be well characterized by Figure 1. It illustrates the evolution of the OECD index of the strictness of EPL for both regular (top) and temporary (bottom) employment between the late 1980s and 2003. In the Figure at the top very few countries are located below the 45° line, suggesting that protection legislations for PE were left unchanged. At this regard, Spain and Portugal constitute an exception, where respectively in 1997 and 2001 protection legislations for permanent contracts were significantly relaxed. Differently, in the Figure at the bottom very few countries lie close to the bisector, symptomatic of the extensive reformatory process concerning the use of TE.

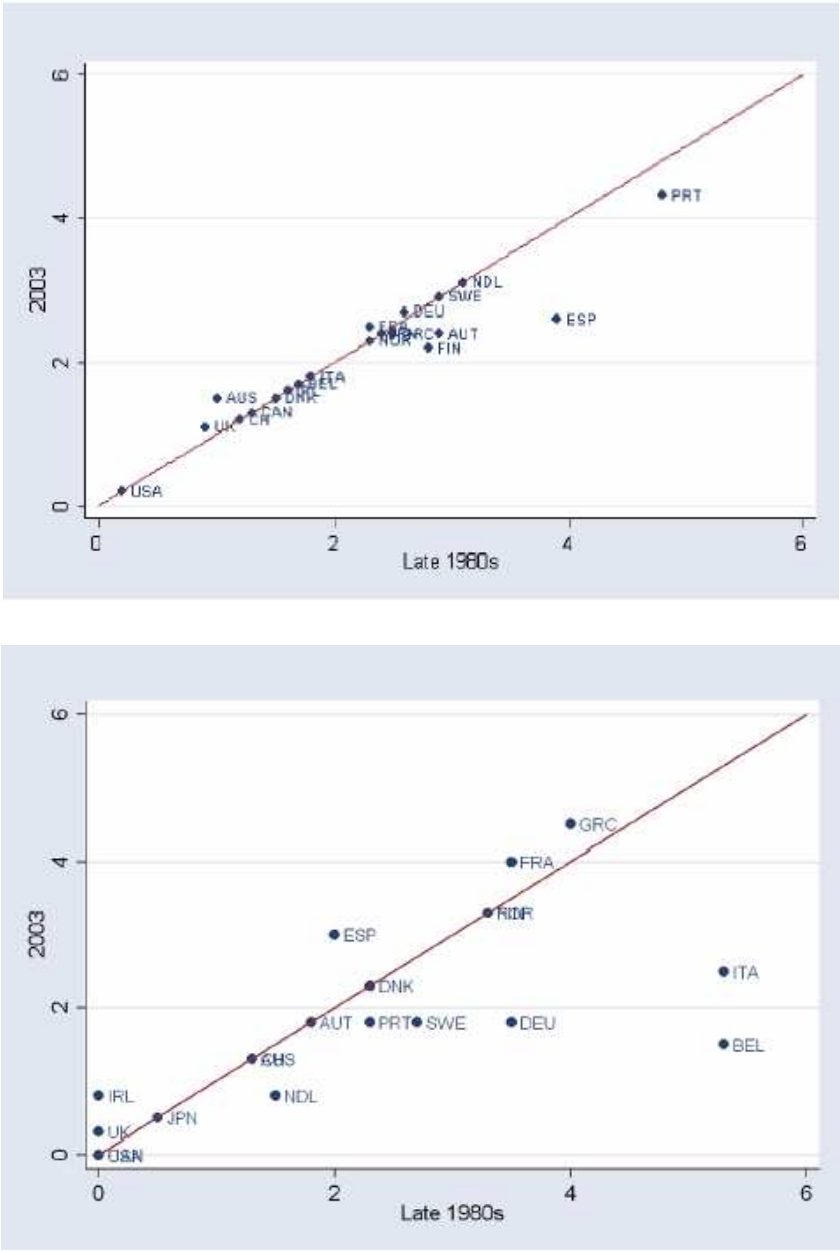
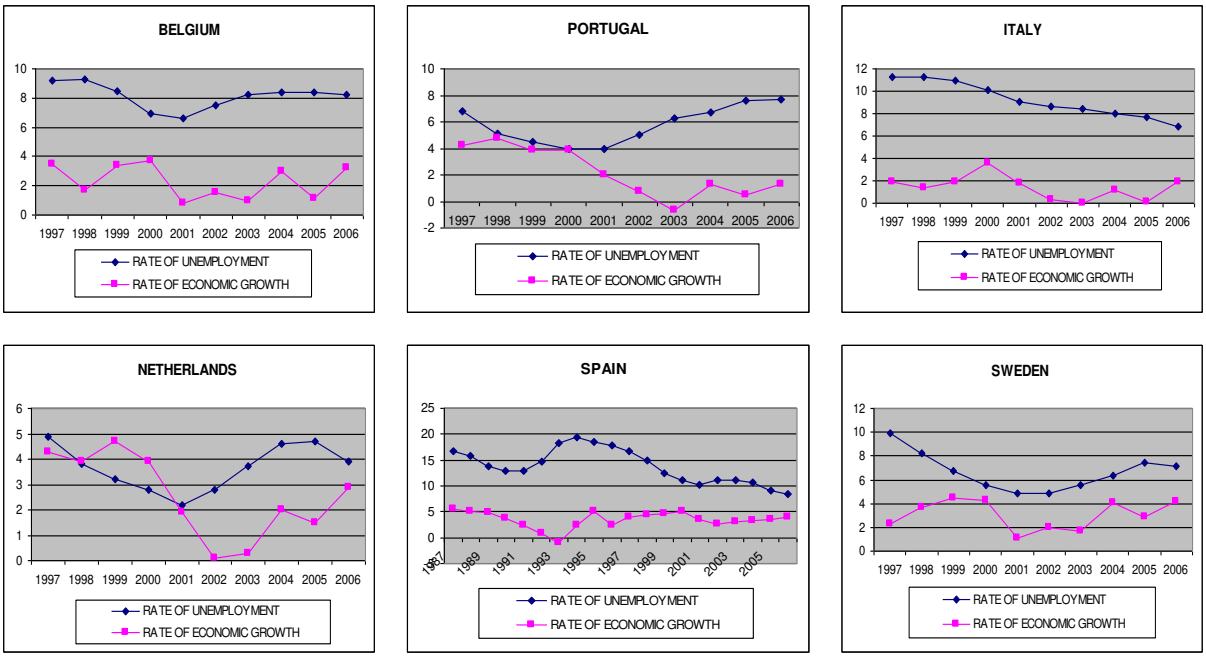


Fig. 1 *OECD index of the strictness of EPL for permanent (top) and temporary (bottom) contracts*

In order to get some insight on the macro-impact of this structural change, in the Figure 2 we report the graphs of unemployment rate and growth rate in the transition time of a representative sample of EU countries. To choose the sample we make use of the Figure 1, selecting those countries staying far from the 45° line in the figure at the bottom. Following this suggestion, an appropriate sample could be: Belgium, the Netherlands, Italy, Portugal, Spain, Sweden. Indeed, as it can be seen from the Figure 1 (bottom), in Spain between the late 1980s to 2003 there was a freeze in the regulation for TE, rather than a liberalization. Nonetheless, the liberalization process in Spain started in the early 1980s, before the time period covered.

Moreover, as can be seen from the Figure 1 (top), in Spain and Portugal there was not only a change in the regulation for TE, but also a relaxation of the protection legislation for PE.

At the bottom of the Figure 2 we report the year of reforms for all countries. For Spain and Portugal we report two dates, the first one concerning the liberalization of TE and the second one the relaxation of the protection for PE. To get the dates of reforms we make use of the *frdb* (Fondazione Rodolfo De Benedetti) inventory of social policy reform. This dataset records detailed information about social reforms, included EPL, in EU15 countries. In all countries in the sample there was more than one reform, as a result of the political convenience to make the reformatory process more gradual. Following the previous literature, we identify the reform date in a country as the date of the most important and crucial intervention in this gradual process.



Reform dates:
Belgium 1997; Portugal 1996-2001; Italy 1997;
Netherlands 1999; Spain 1985-1997; Sweden 1997

Fig. 2 *Unemployment rate and Growth rate in the EU countries*

With the *caveat* of a graphical analysis in mind, from the Figure 2 we can identify some important macrofacts, characterizing those countries experiencing a typical reformatory

process. In EU countries, after the liberalization of TE, there was a decrease in unemployment and an increase in growth. After the first years, there was a slackening in growth, despite the employment was keeping to increase, condition often labelled as *growthless job creation*. Finally, there was a realignment of the unemployment rate towards the pre-reform level.

Another common denominator was the strong contribution of temporary contracts to the increase in employment (OECD, 2002). Despite the data deny the common perception that OECD countries failed to generate new permanent jobs, it is certainly true that a big part of employment growth was driven by TE, especially in Europe. The growth of temporary jobs accounted for at least two-thirds of total employment growth in Austria, Finland, France, Germany, Iceland, Italy and it played a considerable part in Belgium, Hungary, the Netherlands, Portugal, Spain, Sweden, Turkey, the United Kingdom.

The evidence of the extensive part of TE on job creation, along with the so called *growthless job creation* condition, raises the worry that the new regime could have had a negative effect on labour productivity growth. And this impact would be particularly problematic, given the predominant role of labour productivity growth in underpinning the income growth. The rest of this paper intend to shed light on this question, in order to clarify if the common lines followed by European governments correspond really to the principles of best practice.

3. Previous Literature on EPL and Theoretical Issues

The previous literature on EPL is an immense object and a complete survey of the theme goes beyond the aim of this paper. Nonetheless, in this section we review briefly a selected (the most relevant for our purpose) part of it, and then discuss some theoretical issue surrounding the impact of TE on labour productivity.

The first focus of the literature has been the effect of EPL on labour demand. The first contribution goes back to Lazear (1990), the so called *critique of bonding*, where with perfect competition and flexible wage EPL are perfectly neutral, being the costs of them perfectly internalized by wages. The traditional analysis of labour demand under uncertainty was pioneered by Nickell (1978, 1986) and extended by Bentolila and Bertola (1990) and Bertola (1990). In these labour demand models with sticky wages and adjustment costs, EPL are not neutral but firing restrictions have a negative impact on both firing and hiring decisions. Labour market general equilibrium models come to the similar conclusion that protection legislations

affect negatively job flows and then the speed of adjustment towards the equilibrium (Garibaldi, 1998 and Mortensen and Pissarides, 1999).

A considerable number of empirical studies confirm these theoretical predictions. Autor et al. (2006) make use of a panel at the firm level in the US and find a negative effect of EPL on job reallocation. Blanchard and Portugal (2001) find that job flows are significantly lower in Portugal than in the US, where firing restrictions are notably lower. Among the cross-country studies, OECD (2004) finds that EPL reduce both the inflow rate into unemployment and the outflow rate from it. Similarly, Micco and Pages (2004) find a negative relationship between EPL and job flows. Among the recent empirical studies, Messina and Vallanti (2007) confirm these results.

Nonetheless, the effect on average labour demand is still ambiguous, since there is no reason to believe *à priori* that the disincentive to hire could be greater or smaller than that to fire. Indeed, there are theoretical reasons to propend for both a positive and a negative effect. On one hand, greater EPL and/or the presence of TE could strengthen the bargaining power of protected workers, raising labour costs indirectly and, in turn, reducing employment (Bentolila and Dolado, 1994 and Garibaldi and Violante, 2005). In addition, EPL could be an impediment for the adoption of new technologies and this could prevent the optimal reallocation from declining to growing industries, having a negative impact on the level of employment (Samaniego, 2006 and Bartelsman and Hinloopen, 2005). On the other hand, EPL could promote a greater effort and cooperation through stable relationships (Fella, 2004), and encourage workers to invest more in human capital (Belot et al., 2002), ultimately reducing unemployment.

Thus, it is not surprising that there has been a proliferation of empirical studies trying to solve this question. Still, as emphasized by Baker et al. (2004), both the signs and the magnitudes of the estimated impact on employment and/or unemployment vary considerably to draw a definite conclusion on the direction of the effect. In this study the authors find no effect of EPL on unemployment rate. Similarly, Bertola (1990), Jackman, Layard and Nickell (1996) and OECD (1999) find no effect of EPL on both employment and unemployment. Most recently, Nickell, Nunziata and Ochel (2005) confirm these results.

All studies reviewed so far focus on the structural effect of EPL on labour market performance. Recently, some studies concentrate more on the transitional dynamics of partial EPL reform liberalizing the use of TE and leaving untouched the protection legislation for PE. Boeri and Garibaldi (2007) claim that there is a relation between the *growthless job creation* condition

and the asymmetric reformatory process carried out by EU countries. The article solves a dynamic and stochastic labour demand model before and after the introduction of temporary contracts and firing restrictions for workers pre-reform. They find a honeymoon effect, that is a positive but only temporary effect of TE on employment and a fall in labour productivity, due to decreasing returns to scale. Empirically, they make use of a panel of Italian firms to test the main implications of the model, finding empirical properties in line with the theoretical predictions.

In recent years the interest of the literature has shifted more to the impact of EPL on productivity growth. Similarly to the effect on employment, from a theoretical point of view the direction of the effect is ambiguous. On one hand, EPL could distort the efficient allocation of resources, pushing firms to adjust the employment much less speedily, reducing productivity growth (Hopenhayn and Rogerson, 1993, Saint-Paul, 1997, 2002 and Bartelsman and Hinloopen, 2005). Riphahn (2004) and Ichino and Riphahn (2005), focusing on the behavioural component of labour productivity, find that layoff protection reduces the incentive to exert effort for workers, due to the smaller threat of layoff in response to low performance. On the other hand, layoff protection could promote longer job tenure, making both firms and workers more willing to invest in firm-specific human capital, enhancing productivity growth (Belot et al., 2002).

Nonetheless, the cross-country evidence on the effect of EPL on productivity growth is still inconclusive. From a sample of OECD countries, Nickell and Layard (1999) and Koeniger (2005) find in some specification a weak positive effect on both TFP and labour productivity growth, but the effect disappears in others. Differently, from a sample of Latin American and Asian countries, DeFreitas and Marshall (1998) find a negative impact of EPL on labour productivity growth.

Indeed, cross-country studies could suffer from serious drawbacks, making the interpretation of results at least problematic. The majority of these studies could be affected by an endogeneity problem for at least two reasons. First of all, it might be the case that labour market policies are affected by labour market conditions, making the need to deal with the simultaneity problem. Second, since several factors driving cross-country differences are not observable by the econometrician, EPL might pick up the effect of the omitted variables, biasing the estimated coefficients. Another relevant problem could be the use of EPL index as independent variable in the regression analysis. Since EPL for PE have been often left untouched by reforms, it would be questionable if there is sufficient variation on the covariate to reach the identification

of the effect. Consequently, many studies are forced to insert the overall EPL index in the regression analysis, without distinguishing between PE and TE, even if it would be certainly more correct to keep the covariates distinct.

Differently from the standard cross-country analysis, some recent empirical studies exhibit a more convincing identification strategy. Autor et al. (2007) exploit cross-state differences in the timing of adoption of wrongful-discharge protection norms (as exceptions to the employment-at-will principle) by state courts in the US, to identify the impact of layoff protection on TFP, finding a significant reduction on productivity.

A new identification strategy (indeed, the same exploited here in this paper) has been the first time introduced to evaluate labour market policies by Micco and Pages (2006). They use a difference-in-differences approach on a cross-country of industry-level dataset for OECD and non-OECD countries, to identify the effect of EPL on the level of labour productivity. Their main identification assumption is that EPL are much more binding in those industries characterized by a larger necessity to reallocate resources, generating an ulterior exogenous source of variation. The main problem with this identification strategy is that, since the actual turnover rates are themselves affected by EPL, they cannot be used as the natural need to reallocate resources in industries. Therefore, to discriminate between *binding industries* and *non-binding industries*, the authors use turnover rates in the US, where firms decision on job flows are taken essentially in a frictionless environment. They find that EPL have a negative impact on the level of labour productivity. However, as the theoretical literature suggests, it would seem more appropriate to allow the empirical specification to control for the effect of EPL on long-run labour productivity growth, rather than only on the level of labour productivity. Additionally, their finding would seem to depend too much on the presence of Nigeria in the sample, invalidating the generalization of results. Moreover, as previous cross-country studies, they use the overall EPL index in the regression analysis, rather than to distinguish between PE and TE.

The same identification strategy has been extended by Bassanini and Venn (2007), OECD (2007) and Bassanini et al. (2008), apparently overcoming the previous drawbacks. First of all, these studies do control for the effect of EPL on productivity growth, even if the main dependent variable is TFP rather than labour productivity. Second, they use a limited sample of OECD countries, eliminating those countries characterized by particular events, and the results do not seem to depend on the inclusion of some observation in the sample. Third, they do distinguish between EPL for regular and temporary contracts. They find that EPL for regular

contracts have a negative effect on TFP growth, whereas find no effect of EPL for temporary contracts.

Using a similar methodology, this paper intend to enhance the understanding of the effect of labour market regulation on labour productivity growth, focusing on the introduction of TE. Indeed, though acknowledging all merits to previous studies, main source of inspiration of this paper, it is our opinion that they fail to reach the identification of the effect of TE on productivity growth.

In particular, while the EPL index for regular contracts is certainly a correct independent variable, the EPL index for temporary contracts would not seem to be the appropriate independent variable to identify the effect of the introduction of TE. The EPL index for regular contracts expresses the degree of layoff protection for permanent workers. Therefore, it certainly influences firms and workers behaviour on investment and effort, affecting directly labour productivity. Differently, the EPL index for temporary contracts does not express the degree of layoff protection but the permissiveness to use temporary contracts, which indeed are the true variable potentially affecting firms and workers behaviour and thus labour productivity. Therefore, the index influences labour productivity only to the extent firms actually use temporary contracts. Evidently, it affects the use of TE by firms, but it is certainly difficult to establish what is the relation between the timing of a reform introducing the use of temporary contracts and their actual use and expansion in the labour market. Thus, it might be more appropriate to use directly the share of TE as independent variable, rather than the EPL index for temporary contracts. In this way we are able to isolate the impact of TE on labour productivity growth, without passing through the relation between the EPL index and actual use. Moreover, using the share of TE as covariate, we do not need to rely on some assumption concerning the way the index affect the behaviour (that is, the use of TE) in different industries.

Another important difference with respect to previous studies is the definition of the natural need to job reallocation in an industry. Instead of using turnover rates in the US, we apply the method proposed by Ciccone and Papaioannou (2006, 2007) to estimate a frictionless natural need to job reallocation in each industry.

From a theoretical point of view it is not clear what would be the effect of the introduction of TE on labour productivity. On one hand, TE is disproportionally filled by younger, less educated and less experienced workers (OECD, 2007, 2002), and temporary workers often have less access to training programmes (OECD, 2002 and Bassanini et al. 2007). Additionally,

TE could affect negatively the average labour productivity simply because of decreasing returns to scale (Boeri and Garibaldi, 2007). Moreover, given the temporary, and frequently short, duration of contracts it might be rationale for a firm to fix a lower reservation productivity under which to layoff temporary workers than permanent ones, in order to avoid the direct and indirect firing costs (Lisi, 2007). On the other hand, TE allows firms a much more flexible and, in turn, efficient organization of resources and eliminates the disincentive to invest in risky, but potentially valuable, projects. Moreover, it might be rationale for temporary workers to exert a greater effort in order to get the renewal of the contract and/or the passage to a stable job (Engellandt and Riphahn, 2004). Therefore, the issue of the effect of TE on labour productivity remains an empirical question.

4. Empirical Strategy and Data

In this section we illustrate the empirical strategy used in the study, describing all steps from the initial assumptions to the final estimating equations. Then, the main features of the dataset are introduced.

Empirical Specification

The empirical strategy follows the method introduced in the finance literature by Rajan and Zingales (1998) to evaluate the impact of some market regulation, then extended in labour policy evaluation by Micco and Pages (2006) and Bassanini and Venn (2007). The main assumption of this approach is that while the degree of regulation is equal for all industries in a given country, the impact of it could be different in different industries, according to the physiological characteristics of each sector, such as technology, stability of tastes, incidence of aggregate shocks. In particular, regarding EPL the main assumptions made in the literature are that firing restrictions affect productivity growth and that they are much more binding in those industries characterized by a higher natural need to job reallocation. In this study we maintain these assumptions only for the EPL index for regular contracts, whereas we do not assume a different binding for temporary contracts, given that we use directly the share of TE as independent variable.

For what concern EPL studies, the main problem is to recover an appropriate measure of natural need to job reallocation in each industry. In fact, since the actual turnover rates are themselves affected by EPL, they cannot be used as the natural need to job reallocation. The

method proposed by Rajan and Zingales (1998) to deal with this problem is to use data from a frictionless country as a proxy for the physiological characteristics of each industry. Following this idea, a standard approach to classify industries in EPL studies is to use turnover rates in the US, usually considered the quintessential frictionless country (Micco and Pages, 2006, Bassanini and Venn, 2007 and Bassanini et al., 2008).

Dividing industries in *binding industries* (B) and *non-binding industries* (NB), the difference between total factor productivity growth in B and NB can be modelled as some function of some index of the degree of regulation, in our case EPL index for PE:

$$\overline{\Delta \log TFP}_{it}^{B} - \overline{\Delta \, log \, TFP}_{it}^{NB} = f\,(EPL_{it}) \qquad (1)$$

where the first element indicates the average of total factor productivity growth over B in country *i* at time *t*, the second one the same for NB and *f* is some function. As it is the case, EPL does not vary across industries. If we assume that *f* in (1) is linear, then we could estimate the impact of EPL for PE using both a specification in levels or in growth rates:

$$\log TFP_{ijt} = \alpha\left(BI_j * \sum_{k=1}^{t} EPL_{ik}\right) + \beta \sum_{k=1}^{t} EPL_{ik} + \gamma \sum_{k=1}^{t} X_{ijk} + \mu_i + \delta_j + \varphi_t + \varepsilon_{ijt} \qquad (2)$$

$$\Delta \log TFP_{ijt} = \alpha\left(BI_j * EPL_{it}\right) + \beta\, EPL_{it} + \gamma\, X_{ijt} + \theta_t + \omega_{ijt} \qquad (3)$$

The two specifications are completely identical, in fact specification (3) is the first-difference version of specification (2) with $\theta_t = \varphi_t - \varphi_{t-1}$ and $\omega_{ijt} = \varepsilon_{ijt} - \varepsilon_{ijt-1}$. In both specifications BI_j is a binary indicator equal to 1 if *j* is a binding industry, X_{ijt} are other independent variables affecting TFP growth such as the share of TE, α is the marginal effect of EPL for PE on TFP growth in binding industries, whereas μ_i, δ_j and φ_t represent respectively country, industry and time-specific fixed effects, allowed to be correlated with other covariates.

Indeed, in this specification one is constrained to fix a rule to divide all industries between binding and non-binding and then to consider the impact in all binding industries equal to each other and the impact in all non-binding industries equal to zero. Instead of dividing industries between binding and non-binding, it would be more correct to weight the impact of EPL for PE with some plausible natural rate of job reallocation for each industry. This approach leads to the following difference-in-differences specification:

$$\log TFP_{ijt} = \alpha\left(FJR_j * \sum_{k=1}^{t} EPL_{ik}\right) + \beta \sum_{k=1}^{t} EPL_{ik} + \gamma \sum_{k=1}^{t} X_{ijk} + \mu_i + \delta_j + \varphi_t + \varepsilon_{ijt} \qquad (4)$$

where FJR_j is some plausible measure of the natural (frictionless) rate of job reallocation in each industry. The usual approach in EPL literature is to use turnover rates in the US, that is $FJR_j = USJR_j$. In this specification the interpretation of α is less direct than the previous one, but still meaningful. In particular, it tells us how TFP growth in an industry with a relatively high need to job reallocation (HJR) changes with respect that in an industry with a relative low one (LJR) when EPL index increases. For instance, if the estimated coefficient is negative, then this tells us that TFP growth in HJR decreases with respect to that in LJR, meaning that EPL for PE have a negative impact on productivity growth.

Indeed, the use of turnover rates in the US has not been exempt from criticisms in the literature. It has been noted that the appropriateness of this approach relies on the homogeneity of sectors classification across countries in the sample. In a recent paper Cingano et al. (2009) discuss this problem, showing as within sector heterogeneity would limit the validity of the use of the US data as a proxy for the natural rate of job reallocation. Additionally, it has been claimed that this approach would produce a short rather than a long-run measure of job reallocation, due to the incidence of aggregate shocks to the actual data (Fisman and Love, 2003 and Ciccone and Papaioannou, 2006).

In the same paper Ciccone and Papaioannou (2006) developed a method to obtain a measure of physiological rate of job reallocation in each industry, depurated from the frictions introduced by labour market regulation and the effect of aggregate shocks. They regress the actual job reallocation rate at industry level on industry dummies π_j, industry dummies interacted with the EPL index for PE $\tau_j * EPL_{it}$ and country-time dummies ϑ_{it}:

$$JR_{ijt} = \pi_j + \tau_j * EPL_{it} + \vartheta_{it} + v_{ijt} \quad (5)$$

The presence of country-time dummies ϑ_{it} controls for any time-varying differences across countries, whereas the interaction term $\tau_j * EPL_{it}$ absorbs the effect of market regulation on job reallocation rate, allowing us to obtain an appropriate estimate $\hat{\pi}_j$ of natural rate of job reallocation in each industry. In the paper by Cingano et al. (2009) the authors compare the results obtained with the two methods to assess the appropriateness of the standard approach to use the US data, concluding in favour of the second method. Hence, in the following empirical analysis we will use the frictionless measure obtained from (5), that is we will use $FJR_j = \hat{\pi}_j$, bounding the use of binding/non-binding approach only for sensitive analysis. Following Davis and Haltiwanger (1992) and Cingano et al. (2009), we define the job reallocation rate as:

$$JR_{ijt} = \frac{\left|E_{ijt} - E_{ijt-1}\right|}{\left(E_{ijt} + E_{ijt-1}\right)/2}$$

where E_{ijt} is the level of employment in industry *j*, in country *i*, at time *t*. Evidently, this measure treats symmetrically job creation and job destruction, in accordance with the theoretical literature (Bentolila and Bertola, 1990 and Bertola, 1990).

We assume a Cobb-Douglas production function with constant returns to scale at the industry level:

$$Y_{ijt} = A_{ijt} K_{ijt}^{\rho} L_{ijt}^{1-\rho} \quad (6)$$

where Y_{ijt} is total output, A_{ijt} is total factor productivity, K_{ijt}^{ρ} is capital and $L_{ijt}^{1-\rho}$ is labour. To obtain the estimating equation we divide for L_{ijt}, take the logs and substitute (4) in (6):

$$\log y_{ijt} = \rho \log k_{ijt} + \alpha \left(FJR_j * \sum_{k=1}^{t} EPL_{ik}\right) + \beta \sum_{k=1}^{t} EPL_{ik} + \gamma \sum_{k=1}^{t} X_{ijk} + \mu_i + \delta_j + \varphi_t + \varepsilon_{ijt}$$

where y_{ijt} is labour productivity, k_{ijt} is the capital-labour ratio and the rest is as in (4). Finally, to the extent that the level of EPL and TE affect firms decision on investment and, in turn, the level of capital affects labour productivity growth, we omit the capital-labour ratio and estimate a reduced form model to capture the overall effect on labour productivity growth:

$$\log y_{ijt} = \alpha\left(FJR_j * \sum_{k=1}^{t} EPL_{ik}\right) + \beta \sum_{k=1}^{t} EPL_{ik} + \gamma \sum_{k=1}^{t} X_{ijk} + \mu_i + \delta_j + \varphi_t + \varepsilon_{ijt} \quad (7)$$

In what follows, equation (7) represents the baseline specification for the empirical analysis. We estimate different specifications of (7) to test the robustness of the results. To the extent that firing restrictions affect the behaviour of only permanent workers, in some specification we interact the EPL index for PE with the share of permanent workers.

To some extent, this specification is similar to that of Bassanini and Venn (2007) and Bassanini et al. (2008), with the difference that while they use turnover rates in the US and the same identification strategy for PE and TE, we use the estimates from (5) as measure of FJR and distinguish the identification strategy between PE and TE. One the other hand, the specification is even more similar to that of Cingano et al. (2009), with the difference that while they use the same identification strategy for the two EPL indexes, we distinguish between EPL for PE and TE.

As emphasized by the previous literature, the advantage of using a panel of industry-level data, instead of cross-country, is fourfold. First, not only the cross-country variation of EPL is still exploited, but also the variation on the impact of EPL in different industries. And considering that the amount of variation in EPL index for PE across countries and years is indeed not so high, this advantage could be crucial in yielding the sufficient variation to identify the impact of EPL. Second, in contrast with the cross-country analysis, the specification allows us to control for unobserved fixed effects, allowed to be correlated with covariates. Given the difficulty to control for all factors (potentially correlated with covariates) affecting labour productivity growth, this could be crucial to overcome both omitted variable bias and misspecification. Third, as the previous literature emphasised (OECD, 2007b), the within-industry "composition effect" appears to be negligible, allowing us to identify the "independent effect" of EPL for PE and TE. Fourth, to the extent that events in a single industry are not able alone to affect the policy in a country, the specification is less subject to the simultaneity problem between variable of interest and policy.

Indeed, all previous papers using industry-level data share these advantages. In addition, in this paper we introduce a different (respect to EPL for PE) treatment for TE which, for the reasons argued above, we believe should increase the identification power of the empirical analysis.

Data

The empirical analysis is performed on an industry-level panel of EU countries. At the beginning of the data collection the program comprised a wider dataset than the final one, including more countries as the United States, Canada, Australia, a deeper segmentation across sectors and a more extensive time period. However, on one hand the need to include the share of TE as independent variable obligated us to reduce the time period and limit the sample to EU countries. On the other hand, the need to homogenize the sectors segmentation among different data-sources constrained to use the most comprehensive segmentation. At this regard, all data-sources follow the NACE classification, but not at the same level of aggregation. In particular, EUROSTAT data are segmented at the most extensive level of aggregation, therefore we aggregate all the data at that level.

The final sample covers 10 sectors in 13 countries over the years 1992-2005, for a balanced panel of 1820 observations. Despite the sample reduction, it is evident from the data analysis that the final sample exhibits a sufficient amount of variation to reach the identification. Countries included in the sample are Austria, Belgium, Denmark, Finland, France, Germany,

Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. The final sectors segmentation satisfies the need of homogeneity among datasets and reflects the EUROSTAT segmentation, including "Agriculture, hunting and forestry", "Manufacturing", "Electricity, gas and water supply", "Construction", "Wholesale and retail trade", "Hotels and restaurants", "Transport, storage and communication", "Financial intermediation", "Real estate, renting and business activities", "Other community, social, personal service activities".

To collect our dataset we make use of different sources. The data on labour productivity and employment level at the industry-level are collected from EU KLEMS dataset. This comprehensive database contains data on economic growth, productivity, employment and other variables at the industry-level for all EU countries, providing an important data-source for policy evaluation. Moreover, productivity measures are developed with growth accounting techniques, coherently with our empirical specification. The mean of labour productivity in the entire sample is 108,57, whereas the mean omitting 1992-1993-1994 is 111,91, telling us that labour productivity grew from 1995 (base year = 100) to 2005 in EU countries, even if not so significantly. The data on employment level are used to construct the actual job reallocation rates, needed to obtain our measures of natural rate of job reallocation for each industry. While the estimated natural rates of job reallocation are contained in a restricted range, the actual job reallocation rates are much more changeable, going from 0,2388 to 0. This large difference confirms the criticism according to which actual job reallocation rates are significantly influenced by aggregate shocks, producing a short rather than a long-run measure of the natural need of job reallocation.

The shares of TE at the industry-level are constructed from EU – Labour Force Survey (EUROSTAT), a labour market survey providing annually and quarterly information about trends on the labour market in EU countries. The mean and the standard deviation in the sample are respectively 0,09 and 0,075, confirming the idea that TE is by now an important feature of the labour market landscape in Europe, but its importance differs significantly across countries. For instance, while in countries as Spain and Portugal the share of TE is far away from the mean, in the UK the mean is no more than 0,05.

As measure of EPL for PE we make use of the cardinal index constructed by OECD (2004), varying in theory from 6 for the most stringent to 0 for the least stringent regulation. The time-series for the EPL index are currently available until 2003, except for some country where there has been some significant change in the regulation after 2003 (e.g. in Portugal 2004). To the extent that from 2003 to 2005 there not seem to have been significant changes in the regulation

of PE (and, if any, they are included in the time-series), for the values after 2003 we consider the least value available. In our sample the EPL index ranges from 4,33 in Portugal (1992-2003) to 0,95 in the UK (1992-1999). The mean of the index follows a slightly decreasing trend, going from 2,46 at the beginning of the sample 1992, to 2,31 at the end 2005. Indeed, the decreasing trend in the stringency of regulation of PE is far away from being common to all countries, rather it seems to be driven by changes in Spain and Portugal.

Even if the EPL index for TE is not used in the regression analysis, it is useful to see what happen to the index in our sample. The EPL index for TE ranges from 5,38 in Italy (1992-1996) to 0,25 in the UK (1992-2001). Similarly to PE, the mean of the index for TE follows a decreasing trend, going from 2,92 in 1992 to 1,92 in 2005. But differently to PE, the decreasing trend seems to be a common feature in fairly all EU countries.

Unfortunately no data on trade union density at industry-level are available, therefore they are collected at country-level from OECD – Labour Force Statistics. The mean in the sample is 0,41, telling us how trade union are still an important subject in Europe. However, a standard deviation of 0,23 suggests how different is its importance across EU countries. In the sample trade union density ranges from 0,84 in Sweden (1993) to 0,08 in France (2005).

A full description of all variables and sources can be found in Annex 1, whereas descriptive statistics are in Annex 2.

5. Results

In this section we discuss the main results of the empirical analysis, along with some robustness checks. First of all, we present the results of the baseline specification (7), with and without the interaction of the share of PE with the EPL index. Then, we provide some sensitive analysis to check if our findings are robust to little changes in the specification and sample. Finally, in order to show the advantage of our identification strategy, we re-estimate the model using the EPL index for TE instead of the share of TE as independent variable.

Baseline Specification

In Table 1 are the coefficients of different specifications of equation (7). In the first two columns we run a POLS regression, in (2) with other covariates. In both specifications the point estimates of EPL*FJR and TE are negative, the coefficient of TE is significant at 1%, but that

Table 1. LABOUR PRODUCTIVITY (without PE%)

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	POLS	FE	FE	FE	FE
EPL	0,009	0,004	0,013	0,005	0,005	0,005
	(0,001)***	(0,001)***	(0,001)***	(0,002)***	(0,002)**	(0,002)**
EPL*FJR	-0,040	-0,048	-0,073	-0,076	-0,077	-0,077
	(0,027)	(0,026)*	(0,028)***	(0,028)***	(0,040)**	(0,040)**
TE%	-0,077	-0,100	-0,072	-0,081	-0,082	-0,080
	(0,006)***	(0,007)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***
TUD		-0,001		-0,002		-0,002
		(0,000)***		(0,002)		(0,002)
TREND		0,024		0,022		0,626
		(0,002)***		(0,003)***		(0,007)***
CONSTANT	4,582	4,554				
	(0,007)***	(0,008)***				
SECTOR DUMMIES	NO	NO	YES	YES	YES	YES
COUNTRY DUMMIES	NO	NO	YES	YES	YES	YES
YEAR DUMMIES	NO	NO	NO	NO	YES	YES
Observations	1820	1820	1820	1820	1820	1820
R-squared	0,1915	0,3079	0,9992	0,9993	0,9993	0,9993

POLS: pooled ordinary least squares; FE: fixed effects (dummy variable regression). EPL: employment protection legislation; FJR: frictionless job reallocation; TE%: the share of temporary employment; TUD: trade union density.
Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

of EPL*FJR is significant only in (2). While these estimates are useful to get an insight on the direction of the effect, they cannot be interpreted as causal impact, given the omitted variable bias. In the other columns we implement a FE regression, where we allow specific factors to be correlated with EPL and TE. In columns (3)-(4) we introduce country and sector dummies to control for institutional and technological specific effects. In both specifications the coefficients of EPL*FJR and TE are negative and significant at 1%. In columns (5)-(6) we include also time dummies to control for differential trends without any sizable difference. Since we are able to control for all unobserved factors, we interpret these results as causal impact of EPL and TE on labour productivity growth. The magnitude of the coefficient of TE is -0,08 or more, implying that an increase of 10% of the share of TE would lead to a decrease of about 1% in labour

productivity growth. Furthermore, the coefficient of EPL*FJR is sizably greater than that of EPL, implying that EPL for regular contracts reduce labour productivity growth more in those industries requiring a greater reallocation.

To the extent that firing restrictions affect the behaviour of only permanent workers, in Table 2 we interact the EPL index for PE with the share of permanent workers PE% (= 1 – TE%). This inclusion might improve the identification power of the empirical method for EPL for PE. Indeed, the results are qualitatively similar to those of Table 1, but as expected the coefficients of EPL*FJR are greater in all specifications.

Table 2. LABOUR PRODUCTIVITY (with PE%)

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	POLS	FE	FE	FE	FE
EPL	0,010	0,004	0,014	0,006	0,006	0,006
	(0,001)***	(0,001)***	(0,002)***	(0,002)***	(0,002)**	(0,002)**
EPL*FJR*PE%	-0,043	-0,049	-0,091	-0,090	-0,091	-0,090
	(0,029)	(0,028)*	(0,045)**	(0,030)***	(0,046)**	(0,046)**
TE%	-0,058	-0,096	-0,049	-0,077	-0,079	-0,076
	(0,005)***	(0,006)***	(0,008)***	(0,008)***	(0,008)***	(0,008)***
TUD		-0,001		-0,002		-0,002
		(0,000)***		(0,002)		(0,002)
TREND		0,024		0,021		0,625
		(0,002)***		(0,003)***		(0,008)***
CONSTANT	4,575	4,554				
	(0,007)***	(0,008)***				
SECTOR DUMMIES	NO	NO	YES	YES	YES	YES
COUNTRY DUMMIES	NO	NO	YES	YES	YES	YES
YEAR DUMMIES	NO	NO	NO	NO	YES	YES
Observations	1820	1820	1820	1820	1820	1820
R-squared	0,2045	0,3077	0,9992	0,9993	0,9993	0,9993

POLS: pooled ordinary least squares; FE: fixed effects (dummy variable regression). EPL: employment protection legislation; FJR: frictionless job reallocation; TE%: the share of temporary employment; PE%; the share of permanent employment; TUD: trade union density.
Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

Robustness Checks

In what follows, we provide some sensitive analysis to check the robustness of our findings. Despite we maintain the supremacy of the method proposed by Ciccone and Papaioannou (2006), we re-estimate the model using a binding/non-binding approach. Following the previous empirical literature, we make use of job reallocation rates in the US to divide between *binding* (B) and *non-binding industries* (NB). We estimate the model with two different *binary indicators* (BI).

Table 3. LABOUR PRODUCTIVITY (with BI1)

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	POLS	FE	FE	FE	FE
EPL	0,008	0,002	0,010	0,002	0,002	0,002
	(0,001)***	(0,001)**	(0,001)***	(0,002)	(0,001)*	(0,001)*
EPL*BI1	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
	(0,0003)***	(0,0003)***	(0,0003)***	(0,0004)***	(0,0004)***	(0,0004)***
TE%	-0,073	-0,096	-0,067	-0,075	-0,077	-0,075
	(0,006)***	(0,006)***	(0,009)***	(0,008)***	(0,008)***	(0,008)***
TUD		-0,001		-0,002		-0,002
		(0,000)***		(0,002)		(0,002)
TREND		0,024		0,021		0,631
		(0,002)***		(0,003)***		(0,007)***
CONSTANT	4,582	4,553				
	(0,006)***	(0,008)***				
SECTOR DUMMIES	NO	NO	YES	YES	YES	YES
COUNTRY DUMMIES	NO	NO	YES	YES	YES	YES
YEAR DUMMIES	NO	NO	NO	NO	YES	YES
Observations	1820	1820	1820	1820	1820	1820
R-squared	0,1999	0,3141	0,9992	0,9993	0,9993	0,9993

POLS: pooled ordinary least squares; FE: fixed effects (dummy variable regression); EPL: employment protection legislation; BI1: binary indicator 1; TE%: the share of temporary employment; TUD: trade union density.
Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

For the first BI1 an industry is B if the job reallocation rate in the US is greater than the average for at least two of the three years 2001-2002-2003. According to BI1, the following four industries are B: "Manufacturing", "Transport, storage and communication", "Real estate, renting and business activities", "Other community, social, personal service activities". The second BI is slightly less demanding. For BI2 an industry is B if the job reallocation rate in the US is greater than the average for at least two of the four years 2001-2002-2003-2004. According to BI2, the following five industries are B: "Agriculture, hunting and forestry", "Manufacturing", "Transport, storage and communication", "Real estate, renting and business activities", "Other community, social, personal service activities".

Table 4. LABOUR PRODUCTIVITY (with BI2)

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	POLS	FE	FE	FE	FE
EPL	0,008	0,002	0,010	0,002	0,002	0,002
	(0,001)***	(0,001)**	(0,001)***	(0,002)	(0,002)	(0,002)
EPL*BI2	-0,001	-0,001	-0,002	-0,002	-0,002	-0,002
	(0,001)*	(0,001)*	(0,001)**	(0,001)**	(0,001)**	(0,001)**
TE%	-0,075	-0,098	-0,069	-0,077	-0,079	-0,077
	(0,006)***	(0,006)***	(0,009)***	(0,008)***	(0,009)***	(0,009)***
TUD		-0,001		-0,002		-0,002
		(0,000)***		(0,002)		(0,002)
TREND		0,024		0,022		0,625
		(0,002)***		(0,003)***		(0,007)***
CONSTANT	4,582	4,554				
	(0,006)***	(0,008)***				
SECTOR DUMMIES	NO	NO	YES	YES	YES	YES
COUNTRY DUMMIES	NO	NO	YES	YES	YES	YES
YEAR DUMMIES	NO	NO	NO	NO	YES	YES
Observations	1820	1820	1820	1820	1820	1820
R-squared	0,1919	0,3072	0,9992	0,9993	0,9993	0,9993

POLS: pooled ordinary least squares; FE: fixed effects (dummy variable regression); EPL: employment protection legislation; BI2: binary indicator 2; TE%: the share of temporary employment; TUD: trade union density.
Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

In Table 3 are the results of BI1model. The coefficients of the share of TE are all negative, significant at 1% and very close to the baseline value -0,08. The coefficients of EPL*BI1 are also negative and significant, but as expected the magnitude is significantly different from the FJR specifications. However, the magnitude is fairly equal to the binding/non-binding specification of Bassanini and Venn (2007) and Bassanini et al. (2008). In fact, apparently the BI used in this paper and those used in Bassanini and Venn (2007) and Bassanini et al. (2008) produce a very similar classification in terms of B and NB industries. In Table 4 we estimate the model with BI2. The results are very close to the BI1, with the only difference that the coefficients of EPL*BI2 are slightly less significant, as a consequence of a lower identification power of the second (less demanding) BI.

In summary, using the binding/non-binding approach does not seem to alter the results of the analysis. Nonetheless, for the theoretical reasons discussed above, we maintain the preference for the FJR specification as source of our interpretation.

To check if the baseline results depend crucially on the inclusion of some country in the sample, we re-estimate the model excluding all countries one-by-one. In particular, we run 13 FE regressions equal to specification (6) in Table 1, but using a reduced sample. In Table 5 are the complete results of the 13 regressions, whereas in the Figure 3 are the coefficients of the share of TE, arranged from the greatest to the smallest.

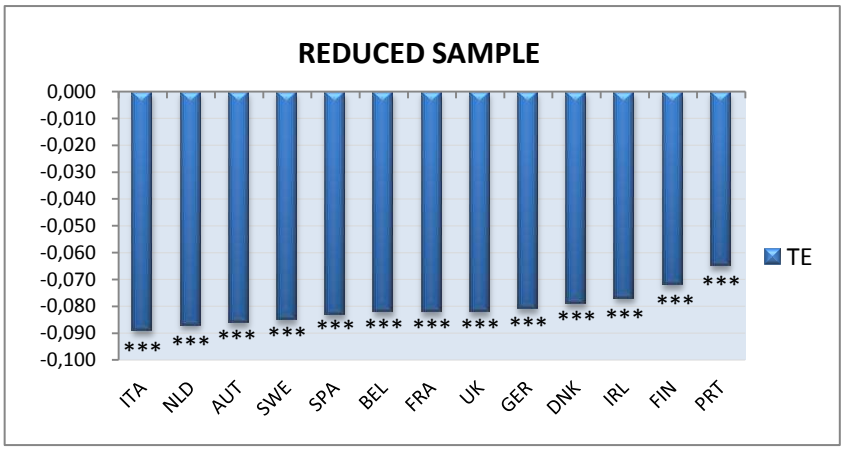


Fig. 3 *Coefficients of TE% from the Reduced Sample*

Table 5. LABOUR PRODUCTIVITY (Reduced Sample)

	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
Excluded Country	AUT	BEL	DNK	FIN	FRA	GER	IRL	ITA	NLD	PRT	SPA	SWE	UK
EPL	0,006	0,004	0,004	0,004	0,005	0,006	0,004	0,004	0,004	0,005	0,006	0,002	0,006
	(0,002)***	(0,002)**	(0,002)**	(0,001)***	(0,002)**	(0,002)***	(0,002)*	(0,002)**	(0,002)**	(0,002)**	(0,002)***	(0,001)*	(0,002)***
EPL*FJR	-0,087	-0,076	-0,079	-0,071	-0,082	-0,101	-0,059	-0,082	-0,056	-0,105	-0,106	-0,025	-0,072
	(0,042)**	(0,041)*	(0,028)***	(0,028)**	(0,042)**	(0,043)**	(0,040)	(0,041)**	(0,029)*	(0,041)**	(0,044)**	(0,028)	(0,029)***
TE%	-0,086	-0,082	-0,079	-0,072	-0,082	-0,081	-0,077	-0,089	-0,087	-0,065	-0,083	-0,085	-0,082
	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,009)***	(0,007)***	(0,016)***	(0,009)***	(0,009)***
TUD	-0,003	-0,001	-0,002	-0,003	-0,003	-0,001	-0,001	-0,001	-0,001	-0,002	-0,003	-0,002	-0,002
	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,003)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)
TREND	0,626	0,627	0,629	0,629	0,629	0,627	0,618	0,627	0,624	0,631	0,666	0,636	0,635
	(0,007)***	(0,007)***	(0,006)***	(0,006)***	(0,008)***	(0,007)***	(0,009)***	(0,007)***	(0,006)***	(0,006)***	(0,024)***	(0,017)***	(0,017)***
SECTOR DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
COUNTRY DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
YEAR DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680	1680
R-squared	0,9993	0,9992	0,9993	0,9993	0,9992	0,9993	0,9993	0,9993	0,9992	0,9993	0,9992	0,9993	0,9992

FE: fixed effects (dummy variable regression); EPL: employment protection legislation; FJR: frictionless job reallocation; TE%: the share of temporary employment; TUD: trade union density.

Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

Evidently, the baseline outcome does not seem to depend on the sample of countries included in the empirical analysis. Indeed, the coefficients of the share of TE are always negative and significant at 1% regardless the sample used.

In conclusion, our findings of a negative impact of both EPL for PE and the share of TE on labour productivity growth are fairly robust to little changes in the estimation method and the sample of countries included in the analysis.

EPL index for TE vs TE%

In order to show the advantage of our identification strategy, we re-estimate the model using the EPL index for TE instead of the share of TE as independent variable. In Table 6 are the results of the experiment.

Table 6. LABOUR PRODUCTIVITY (EPL for TE)

	(1)	(2)	(3)	(4)	(5)	(6)
	POLS	POLS	FE	FE	FE	FE
EPL for PE	0,008	0,003	0,011	0,004	0,004	0,004
	(0,002)***	(0,002)	(0,002)***	(0,003)	(0,003)	(0,003)
EPL for PE*FJR	-0,056	-0,056	-0,073	-0,073	-0,074	-0,074
	(0,059)	(0,057)	(0,054)	(0,054)	(0,055)	(0,055)
EPL for TE	-0,003	-0,004	-0,002	-0,004	-0,004	-0,004
	(0,002)	(0,002)**	(0,002)	(0,002)**	(0,002)**	(0,002)**
EPL for TE*FJR	0,042	0,042	0,034	0,034	0,033	0,033
	(0,048)	(0,046)	(0,036)	(0,035)	(0,035)	(0,035)
TUD		-0,001		-0,002		-0,001
		(0,000)***		(0,002)		(0,002)
TREND		0,023		0,022		0,642
		(0,002)***		(0,004)***		(0,008)***
CONSTANT	4,586	4,553				
	(0,007)***	(0,009)***				
SECTOR DUMMIES	NO	NO	YES	YES	YES	YES
COUNTRY DUMMIES	NO	NO	YES	YES	YES	YES
YEAR DUMMIES	NO	NO	NO	NO	YES	YES
Observations	1820	1820	1820	1820	1820	1820
R-squared	0,1321	0,2282	0,9992	0,9992	0,9992	0,9992

POLS: pooled ordinary least squares; FE: fixed effects (dummy variable regression); EPL: employment protection legislation; FJR: frictionless job reallocation; TUD: trade union density.
Robust standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%.

Consistently with our view, the use of the same treatment for PE and TE seems to have reduced significantly the identification power of the empirical analysis. Even though we use the same specifications and sample of Table 1, the coefficients of EPL for TE*FJR are always insignificant and those of EPL for TE are estimated with a very little precision. Moreover, despite the point estimates of EPL*FJR remain negative, they become always insignificant, which would be heavily in contrast with standard findings of this and previous papers in the literature.

In conclusion, for the theoretical reasons discussed above, the identification strategy for PE does not appear to be appropriate for the identification of the effect of TE on labour productivity growth. Indeed, the empirical comparison between the use of the share of TE and the EPL index for TE confirms the theoretical drawbacks highlighted in the paper and suggests a clear preference for the use of the share of TE.

6. Policy Implications and Final Remarks

In this paper we have implemented a well-know method to evaluate the impact of partial labour market reforms in EU countries. Using an industry-level panel we are able to control for unobserved confounding factors, which allow us to identify the causal impact of both regulation for PE and TE on labour productivity growth. Differently from the previous literature, we distinguish the identification strategy between the impact of firing restrictions for PE and the impact of the use of TE, underlining theoretical reasons to make this distinction. Comparing the model with the share of TE to that with the EPL index for TE, we show as the first improves significantly the identification power of the empirical analysis. For this reason, to some extent the empirical strategy presented in this paper would go to improve the previous empirical literature on labour market policy evaluation.

The only problem with the interpretation of the estimates as causal impact could be the inclusion of trade union data at country-level. Indeed, if trade union density in countries is highly dispersed across sectors, then the coefficient of TE% could pick up the effect of trade union as well. Certainly, the availability of trade union data at industry-level data would make the analysis more robust.

The main finding of the paper is that the introduction of TE has a negative impact on labour productivity growth. In particular, an increase of 10% of the share of TE would lead to a

decrease of about 1% in labour productivity growth. Furthermore, the analysis confirms the findings of the previous literature that EPL for regular contracts reduce labour productivity growth more in those industries requiring for their own characteristics a greater reallocation.

However, the increase of TE should not be considered *a priori* a negative labour market outcome, rather the important issue here is what role TE is playing in the labour market. Indeed, if temporary contracts were used as a least-cost way of screening new workers and as stepping stone towards more stable jobs, then an increase in the share of TE and its effect on productivity growth could be bounded in the short-run. The problem is that, as emphasised by a growing literature (OECD, 2002), only one-third of temporary workers move to a more stable job within two years, whereas one-fourth of them become unemployed one year later and a large part remain steadily in temporary jobs. Therefore, the negative impact of the increase of TE in Europe on productivity growth cannot be considered a short-run problem, but a dangerous structural change with long-run effects.

In the light of the predominant role of labour productivity growth in driving GDP growth, our findings are much relevant and full of policy implications. In particular, the partial labour market reforms made by the majority of EU countries do not seem to correspond to the optimal way to organize labour market regulation.

The aim of the liberalization of TE was to generate a higher level of employment, removing the disincentive to hire intrinsic in a labour market with permanent contracts and layoff restrictions. And it is certainly true that the introduction of less stringent regulations has initially driven the employment growth. However, it is not clear as this expansion could be considered structural or just a honeymoon effect. Indeed, if the expansion of TE dampen labour productivity growth, not only this could restrain GDP growth, generating the so called *growthless job creation* condition, but also re-absorb in the long-run the initial employment growth, generating the honeymoon effect.

The crucial implication is that the expansion of the level of employment could be only transitory and, if the EU governments strive for generate a structural higher level of employment, they need an ulterior reformatory intervention. At this regard, the main challenge is to find a regulation able at the same time to eliminate the disincentive to hire and to motivate firms and workers towards more stable and productive job relationships.

Although the identification of such regime is not the aim of this paper, some final remarks are proper. In the light of the results of this paper it would seem justified the preference expressed

by the most part of the literature for a reduction in EPL for PE, rather than the expansion of TE. However, for both efficiency and equity reasons, it might be more appropriate on one hand to maintain some protection for PE, even if certainly smaller than the actual level in Europe, on the other hand to allow a less intensive use of temporary contracts to facilitate the introduction in the labour market. These considerations would seem to suggest a regime providing for a gradual path from temporary to permanent contracts. For these reasons, on one hand the so called *flexicurity* in Denmark, on the other hand the proposals made by Ichino et al. (Lavoce.info) would seem to prompt the right direction.

In conclusion, I would like to close the discussion surrounding the principles we should keep in mind when we think about such a regime, quoting a brief paragraph by Solow (2002): << If pure unadulterated labour-market reform is unlikely to create a substantial increase in employment, then the main reason for doing it is anticipated gain in productive efficiency, however large that may be. But if we respect the wage earner's desire for job security, and it seems at least as respectable as anyone's desire for fast cars or fat-free desserts, then an improvement in productivity efficiency gained in that way is not a Pareto-improvement. More labour-market flexibility may still be worth having – and I think it is – but then the losers have a claim in equity to some compensation. The trick is to find a form of compensation that does not cancel the initial gain in labour-market flexibility>>.

BIBLIOGRAPHY

Autor, D., Donohue, J. and Schwab, S.J. (2006), 'The Costs of Wrongful-Discharge Laws', *Review of Economics and Statistics*, vol. 88 (2), pp. 211-231.

Autor, D., Kerr, W. and Kugler, A. (2007), 'Does employment protection reduce productivity? Evidence from US states', *Economic Journal*, vol. 117, pp. F189–F117.

Baker, D., Glyn, A., Howell, D. and Schmitt, J. (2004), 'Labour Market Institutions and Unemployment: Assessment of the Cross-Country Evidence', in D. Howell (ed.), *Fighting Unemployment: the limits of free market orthodoxy*, Oxford University Press, Oxford.

Bartelsman, E.J. and Hinloopen, J. (2005), 'Unleashing animal spirits: investment in ICT and economic growth', in L. Soete and B. ter Weel (eds.), *The Economics of the Digital Society*, Cheltenham, UK and Northampton, MA, USA Edward Elgar.

Bassanini, A., Booth, A.L., Brunello, G., De Paola, M. and Leuven, E. (2007), 'Workplace Training in Europe', in G. Brunello, P. Garibaldi and E. Wasmer (eds.), *Education and Training in Europe*, Oxford University Press, Oxford.

Bassanini, A., Nunziata, L. and Venn, D. (2009), 'Job protection legislation and productivity growth in OECD countries', *Economic Policy*, vol. 24 (58), pp. 349–402.

Bassanini, A. and Venn, D. (2007), 'Assessing the Impact of Labour Market Policies on Productivity: A Difference-in-Differences Approach', *OECD Social Employment and Migration Working Papers*, No. 54, OECD Publishing.

Belot, M., Boone, J. and Ours van, J.C. (2002), 'Welfare Effects of Employment Protection', CEPR Discussion Paper No. 3396.

Bentolila, S. and Bertola, G. (1990), 'How bad is eurosclerosis', *Review of Economic Studies*, vol. 57 (3), pp. 381–402.

Bentolila, S. and Dolado, J. (1994), 'Labour flexibility and wages: lessons from Spain', *Economic Policy*, vol. 18, pp. 55-99.

Bertola, G. (1990), 'Job security, employment and wages', *European Economic Review*, vol. 34 (4), pp. 851–866.

Blanchard, O. and Portugal, P. (2001), 'What Hides Behind an Unemployment Rate. Comparing Portuguese and US unemployment', *American Economic Review*, vol. 91 (1), pp. 187–207.

Boeri, T. and Garibaldi, P. (2007), 'Two Tier Reforms of Employment Protection Legislation. A Honeymoon Effects', *The Economic Journal*, vol. 117, pp. 357–385.

Ciccone, A. and Papaioannou, E. (2006), 'Adjustment to Target Capital, Finance and Growth', *mimeograph*, UPF.

Ciccone, A. and Papaioannou, E. (2007), 'Red Tape and Delayed Entry', *The Journal of European Economic Association*, Papers and Proceedings, pp. 444–458.

Cingano, F., Leonardi, M., Messina, J. and Pica, G. (2009), 'The effect of Employment Protection Legislation and Financial Market Imperfections on Investment: Evidence from a Firm-Level Panel of EU countries', *mimeo*.

Davis, S.J. and Haltiwanger, J.C. (1992), 'Gross Job Creation, Gross Job Destruction and Employment Reallocation', *The Quarterly Journal of Economics*, August, vol. 107 (3), pp. 819–863.

DeFreitas, G. and Marshall, A. (1998), 'Labour Surplus, Worker Rights and Productivity Growth: A Comparative Analysis of Asia and Latin America', *Labour*, vol. 12 (3), pp. 515–539.

Engellandt, A. and Riphahn, R. (2004), 'Temporary Contracts and Employee Effort', CEPR Discussion Paper No. 4178.

Fella, G. (2004), 'Efficiency Wage and Efficient Redundancy pay', *European Economic Review*, vol. 44, pp. 1473–1490.

Garibaldi, P. (1998), 'Job Flow Dynamics and Firing Restrictions', *European Economic Review*, vol. 42 (2), pp. 245–275.

Garibaldi, P. and Violante, G. (2005), 'The Employment Effects of Severance Payments with Wage Rigidities', *The Economic Journal*, vol. 115, pp. 799–832.

Hopenhayn, H. and Rogerson, R. (1993), 'Job Turnover and Policy Evaluation: A General Equilibrium Analysis', *The Journal of Political Economy*, vol. 101 (5), pp. 915–938.

Ichino, A. (2006), 'Come superare il dualismo nel mercato del lavoro', http://www.lavoce.info, Lavoro.

Ichino, A. and Riphahn, R.T. (2005), 'The Effect of Employment Protection on Worker Effort: A Comparison of Absenteeism During and After Probation', *Journal of the European Economic Association*, vol. 3 (1), pp. 120–143.

Koeniger, W. (2005), 'Dismissal Costs and Innovation', *Economics Letters*, vol. 88 (1), pp. 79–85.

Jackman, R., Layard, R. and Nickell, S.J. (1996), 'Combatting Unemployment: Is Flexibility Enough?', CEP Discussion Paper No. 0293.

Lazear, E.P. (1990), 'Job Security Provisions and Employment', *The Quarterly Journal of Economics*, August, pp. 699–726.

Lisi, D. (2007), 'Analysis of Employment Protection Legislation: a model with endogenous labour productivity', *mimeo*.

Messina, J. and Vallanti, G. (2007), 'Job Flow Dynamics and Firing Restrictions: the European Evidence', *The Economic Journal*, vol. 117, pp. 279–301.

Micco, A. and Pages, C. (2004), 'Employment protection and gross job flows: a difference-in-differences approach', *mimeograph*, World Bank.

Micco, A. and Pages, C. (2006), 'The Economic Effects of Employment Protection: Evidence from International Industry-Level Data', IZA Discussion Paper No. 2433.

Mortensen, D.T. and Pissarides, C.A. (1999), 'Unemployment responses to "skill-biased" shocks: The role of labour market policy', *Economic Journal*, vol. 109, pp. 242–265.

Nickell, S. (1978), 'Fixed Costs, Employment and Labour Demand over the Cycle', *Economica*, vol. 45, pp. 329–345.

Nickell, S. (1986), 'Dynamic models of labour demand under uncertainty', in O. Ashenfelter and R. Layard (eds.), *Handbook of Labour Economics*, Amsterdam, North Holland.

Nickell, S. and Layard, R. (1999), 'Labour Market Institutions and Economic Performance', in O. Ashenfelter and D. Card (eds.), *Handbook of Labour Economics*, Amsterdam, North Holland.

Nickell, S., Nunziata, L. and Ochel, W. (2005), 'Unemployment in the OECD Since the 1960s. What Do We Know?', *Economic Journal*, vol. 115, pp. 1–27.

OECD (1999), *OECD Employment Outlook*, OECD, Paris.

OECD (2002), *OECD Employment Outlook*, OECD, Paris.

OECD (2003), *The Sources of Economic Growth in OECD Countries*, OECD, Paris.

OECD (2004), *OECD Employment Outlook*, OECD, Paris.

OECD (2007), *OECD Employment Outlook*, OECD, Paris.

Rajan, R. and Zingales, L. (1998), 'Financial Dependence and Growth', *American Economic Review*, vol. 88, pp. 559–586.

Riphahn, R.T. (2004), 'Employment Protection and Effort Among German Employees', *Economics Letters*, vol. 85 (3), pp. 353–357.

Saint-Paul, G. (1997), 'Is Labour Rigidity Harming Europe's Competitiveness? The Effect of Job Protection on the Pattern of Trade and Welfare', *European Economic Review*, vol. 41 (3–5), pp. 499–506.

Saint-Paul, G. (2002), 'Employment Protection, International Specialization and Innovation', *European Economic Review*, vol. 46 (2), pp. 375–395.

Samaniego, R. (2006), 'Employment protection and high-tech aversion', *Review of Economic Dynamics*, vol. 9 (2), pp. 224–241.

Solow, R. (2002), 'Is Fiscal Policy Possible? Is it Desirable?' Presidential address to the XIII World Congress of the International Economic Association, September, Lisbon.

ANNEX 1: DATA DESCRIPTION

Labour Productivity

Definition: gross value added in volume terms (base 1995 = 100) divided by total hours worked.

Source: EU KLEMS database.

Total Hours Worked

Definition: product of average hours worked and total person engaged.

Source: EU KLEMS database.

Employment Level

Definition: total persons engaged.

Source: EU KLEMS database.

Job Reallocation Rate

Definition: Davis and Haltiwanger measure of job reallocation rate $JR_{ijt} = \frac{|E_{ijt} - E_{ijt-1}|}{(E_{ijt} + E_{ijt-1})/2}$.

Source: own calculation from the employment level data from EU KLEMS database.

Frictionless Job Reallocation Rate

Definition: job reallocation rate depurated from the frictions introduced by labour market regulation and the effect of aggregate shocks ($FJR_j = \hat{\pi}_j$).

Source: own estimation.

Temporary Employment

Definition: total persons engaged with temporary contracts.

Source: EUROSTAT Labour Force Survey.

EPL for Permanent Employment

Definition: OECD index of the stringency of employment protection legislation on regular contracts.

Source: OECD *Employment Outlook* (2004).

EPL for Temporary Employment

Definition: OECD index of the permissiveness on the use of temporary contracts.

Source: OECD *Employment Outlook* (2004).

Trade Union Density

Definition: employees trade union members divided by total number of employees.

Source: OECD Labour Force Statistics.

ANNEX 2: DESCRIPTIVE STATISTICS

TABLE A2. DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Labour Productivity	1820	108,565	20,757	63,486	268,792
Log Labour Productivity	1820	4,672	0,170	4,151	5,594
Job Reallocation	1820	0,028	0,027	0,000	0,239
Frictionless Job Reallocation	1820	0,043	0,009	0,028	0,059
Share of TE	1820	0,089	0,075	0,000	0,488
EPL for Regular Contracts	1820	2,372	0,846	0,948	4,333
EPL for Temporary Contracts	1820	2,259	1,278	0,250	5,375
Trade Union Density	1820	0,408	0,232	0,080	0,839